Today's Plant Breeders Increase Tomorrow's Food Supply

In the 1860's, Austrian monk Gregor Mendel bred a tall garden pea plant with a short one and counted the number of tall and short plants in the next two generations from that first mating.

From those observations in his garden, Mendel deduced profound laws of heredity—in the process fathering the modern science of genetics. Unfortunately, his work remained obscure until this century, when it was rediscovered and belatedly came to wide acceptance.

By 1900, the year that Mendel's laws resurfaced, the population of the world numbered 1.625 billion people. World population today is already more than 6 billion.

According to estimates by the U.S. Bureau of the Census, it will hit 7.9 billion by the year 2020—a nearly fivefold increase since 1900. With minor fluctuations, the uptrend is going to continue.

We must ask ourselves: Where will the food for 7.9 billion people come from?

To answer that question, we must first know the origins of the food for today's 6 billion. From 1900 to the present, the history of the United States (and most of the world) is a history of food supply increasing faster than demand. In almost every segment of the globe, fewer farmers are feeding more people. Crop yields have increased since 1900 by at least 1.5 percent annually, outstripping the rate of population growth.

Coincidence? No. It stems in large part from the discoveries of Mendel. His simple observations set in motion a chain of events that have not stopped and, in fact, are still gathering speed.

The science of plant breeding, based on Mendel's laws—selecting desirable plants and crossbreeding them, then selecting and crossing again until the right combination of properties is achieved—is to older methods of plant improvement what a modern computer is to counting on your fingers and toes.

As long as humans have raised crops for harvest, they have practiced plant breeding. Domesticated crops benefit from different properties found in wild plants, such as the ability to hold on to their fruit or grain, instead of dropping it on the ground as soon as it matures.

Much progress was made early on—even without knowing the laws of heredity—because selecting for those visible traits was easy.

Today, we have advanced to breeding for much more subtle characteristics that are not readily visible. These traits greatly affect a crop's ability to resist pests and require fewer pesticide applications, produce a harvest despite drought, or maintain a high vitamin content in its fruits.

To get the most from nature, geneticists are looking for ways to visualize those elusive genes that control the plant's properties.

In this issue of *Agricultural Research*, you'll read about how ARS scientists at Beltsville, Maryland, have found ways to create a unique DNA fingerprint for each variety of soybeans. The fingerprints provide easily visible molecular markers that indicate which hidden genes are present in soybean plants that look identical to the naked eye.

How can molecular markers speed the progress of breeding?

Again in this issue, you'll read that ARS researchers at Raleigh, North Carolina, wanted to improve the process of selecting parents to cross for production of corn hybrids. Molecular markers told them which parental lines had the least duplication of their critical hidden genes. When the marker-identified lines were crossbred, yields increased immediately by 15 percent above the best standard hybrids.

Compare this with the 1.5 percent annual improvement maintained over the last century. Because of molecular markers, it's like 10 years of progress occurred in a single year!

This is the new technology, and it's dazzling.

But markers only offer *assistance* to the breeder, who must still select and breed, select and breed. And the breeder must be aware of every influence—such as unpredictable weather or insect infestations—that can possibly alter the results.

Although plant breeding is more scientific today than ever before, it is still very much an art as well. The new technologies of molecular genetics don't change any of that; they just provide a higher quality scientific brush for the artist to use.

Returning to the question of where our food has come from, the answer is: The plant breeder has brought it to us and will continue to do so. With new high-tech tools such as molecular markers now available, teams of molecular geneticists and plant breeders have begun to work together, combining the newest with the oldest of skills.

The plant breeder will remain at the center of research to improve our food supply. That is why the science of genetics will continue to work for us.

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